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I. Solution by **M. A. GRUBER, A. M., War Department, Washington, D. C.**

A. 40=base, and 120=sum of altitude and hypothenuse of a right-angled triangle.

$(120^2\pm40^2)\div120=133\frac{1}{3}$ and $106\frac{2}{3}$, which are, respectively, two times the hypothenuse, and two times the altitude.

$\therefore$ Hypothenuse$=66\frac{2}{3}$ feet, and altitude$=53\frac{1}{3}$ feet.

$\therefore$ The pole must be broken $53\frac{1}{3}$ feet from its foot.

B. 40=base and 120=sum of altitude and hypothenuse of a right-angled triangle.

Since one of the sides and the sum of the other two sides are rational, each of the sides must be rational.

Also, prime, integral right triangles are the basis of all composite and fractional rational right triangles.

We observe that the base is one-third of the sum of the other two sides. This is the case with *one right triangle of prime, integral sides*, of which the base =3, altitude=4, and hypothenuse=5.

$40=13\frac{1}{3}$ times 3. $\therefore$ The altitude and hypothenuse of the required right triangle are, respectively, $13\frac{1}{3}\times4$, and $13\frac{1}{3}\times5$, or $53\frac{1}{3}$ and $66\frac{2}{3}$.

$\therefore$ The pole must be broken $53\frac{1}{3}$ feet from its foot.

II. Solution by **COOPER D. SCHMITT, A. M., Professor of Mathematics, University of Tennessee, Knoxville, Tenn.; ELMER SCHUYLER, Annapolis, Md.; P. S. BERG, B. Sc., Larimore, N. D.; H. C. WHITAKER, Ph. D., Professor of Mathematics, Manual Training School, Philadelphia, Pa., and G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Science, Chester High School, Chester, Pa.**

$AB=120$ feet, $BC=40$ feet. Since $CD=AD$, $\angle CAD=DCA$.

Hence (geometrically), construct a right triangle with base 40 and perpendicular 120, and join AC. At C, make an angle equal to CAB, and this will give D, the required point.

Algebraically: $AD=CD=x$, $BD=y$, and we have at once $x+y=120$ ......(1), $x^2-y^2=1600$......(2). Dividing (2) by (1) we have $x-y=13\frac{1}{3}$.

Whence $x=66\frac{2}{3}$, and $y=53\frac{1}{3}$.

III. Solution by **CHARLES CARROLL CROSS, Whaleyville, Va.**

A rule, which can easily be established by geometry for solving such problems is as follows: Divide the difference of the squares of the height of the pole and the distance on the ground by two times the height, which will give the part standing. Thus height$=(120^2-40^2)/2\times120=53\frac{1}{3}$ feet.

[Is this an arithmetical solution? C. C. C.]

116. Proposed by **J. O. MAHONEY, B. E., M. Sc., Professor of Mathematics and Science, Cooper Training School, Carthage, Tex.**

Two candles are of the same length. The one is consumed uniformly in 4 hours, and the other in 5 hours. If the candles are lighted at the same time, when will one be three times as long as the other?

Solution by M. A. GRUBER, A. M., War Department, Washington, D. C.; G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Science, Chester High School, Chester, Pa.; ALOIS F. KOVARIK, Instructor in Mathematics and Science, Decorah Institute, Decorah, Ia.; D. G. DORRANCE, Jr., Camden, N. Y.; ELMER SCHUYLER, United States Naval Academy, Annapolis, Md., and COOPER D. SCHMITT, A. M., Professor of Mathematics, University of Tennessee, Knoxville, Tenn.

Let x=the time in hours.

Then, at the end of x hours, the unconsumed portions of the candles will be $\frac{4-x}{4}$ and $\frac{5-x}{5}$ of their respective lengths.

$$\therefore \frac{5-x}{5} \div \frac{4-x}{4} = 3.$$

$\therefore x=3\tfrac{7}{11}$ hours, the time required.

COROLLARY. Putting a and b=the respective times of consumption, $a>b$, and n=the ratio of unconsumed lengths, we have $\frac{a-x}{a} \div \frac{b-x}{b} = n$.

$$\therefore x = \frac{ab(n-1)}{an-b}.$$

GRUBER.

Also solved by *W. F. SHAW*, Austin, Tex.

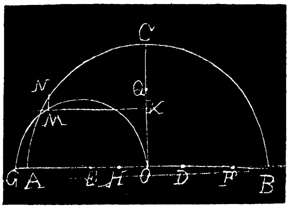
GEOMETRY.

116. **Proposed by P. S. BERG, A. M., Superintendent of Schools, Larimore, N. D.**

Inscribe by rule and compass a regular heptadecagon.

I. **Solution by B. F. FINKEL, A. M., M. Sc., Professor of Mathematics and Physics, Drury College, Springfield, Mo.**

The following construction is found on page 95, Vol. IV, of the *Analyst*. This construction is credited to Leybourne's *Mathematical Repository*, 1818.



Let ACB be a semi-circle. Draw the radius CO perpendicular to the diameter AB; on OC and OB take QO equal to the half, and OD equal to the eighth part of the radius; make DE and DF each equal to DQ, and EG and FH, respectively, equal to EQ and FQ; take OK a mean proportional between OH and OQ, and through K draw KM parallel to AB, meeting the semi-circle described on OG in M; and draw MN parallel to OC, cutting the given circle in N. Then the arc AN is the seventeenth part of the whole circumference. The above figure is not drawn to scale.

For a complete and detailed construction see Klein's *Famous Problems in Elementary Geometry*, translated from the German by Professors Beman and Smith, pages 24—41. An analytic solution due to Ampere may be seen in Casey's *Elements of Euclid*. See also THE AMERICAN MATHEMATICAL MONTHLY, Vol. I, page 376, an article by Dr. L. E. Dickson.